STATE OF CALIFORNIA—BUSINESS, TRANSPORTATION AND HOUSING AGENCY

DEPARTMENT OF TRANSPORTATION
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METHOD OF TESTING CLEANNESS AND SOUNDNESS OF PORTLAND CEMENT CONCRETE SURFACES AND QUALITY OF BONDED OVERLAYS AND SEAL COURSES

CAUTION: Prior to handling test materials, performing equipment setups, and/or conducting this method, testers are required to read "**SAFETY AND HEALTH**" in Section F of this method. It is the responsibility of the user of this method to consult and use departmental safety and health practices and determine the applicability of regulatory limitations before any testing is performed.

A. SCOPE

This test is designed for use in the field or laboratory to develop quantitative data essential to the proper application and evaluation of bonded overlays and seal course.

It is important to locate the areas for testing which are representative of the entire area in question. For instance, in evaluating the cleanness of portland cement concrete roadway surface, it will be necessary to run tests in the tire tracks, between the tire tracks, and along the gutters. Each of these areas may have a different surface condition.

This test method is divided into the following parts:

Part 1	Evaluation of Bonded Overlays and Seal Course
Part 2	Evaluation of Soundness of Portland Cement Concrete Surfaces
Part 3	Evaluation of Cleanness of Portland Cement Concrete Surfaces
Part 4	Method of Testing in a Laboratory

B. APPARATUS

1. Tensile test apparatus used to measure and record the force needed to pull the bobbin from the surface to which it is bonded (see Figure 1). The equipment can be made from Plans D-848 which are obtainable from TransLab.

2. Cable Connector:

   Cable with one end having welded threaded plug so cable can be screwed into bobbin.

3. Bobbins:

   50 $\pm$ 10 mm diameter by 25 to 60 mm steel or aluminum bobbin with threaded hole to receive cable connector.

4. Coring Drill Bit: (See Figure 2)

   A tungsten carbide or diamond-tipped core bit (used to make the annular cut). When the test is issued to measure the adhesion of a bonded overlay or seal course to concrete, an island of overlay of seal course equal in diameter to the bobbin is isolated by using the core bit to cut through the overlay or seal course.

5. Heating Torch:

   A conventional gasoline blowtorch or liquefied propane burner as a heat source (used to speed the cure of the adhesive).

6. Mixing and Application Tool:

   A metal spatula, such as those sold for kitchen use, or wooden tongue depressor.

7. Wire Brush:

A clean, oil-free wire brush (used to roughen and clean surfaces).

C. MATERIALS

1. Bonding agent to glue bobbin to overlay.

   Use any high strength, fast setting, resin adhesive to bond the bobbin to the surface to be tested. Epoxy and hot glue have been used successfully.

PART 1. EVALUATION OF BONDED OVERLAYS AND SEAL COURSE

A. TEST PROCEDURES

1. Drill an annular hole through the overlay or seal course and just down to the concrete base (see Figure 3). An isolated island of bonded overlay equal in diameter to the bobbin is thereby created. Care need be exercised to avoid, as much as possible, applying unnecessary torque at the bond plane.

2. Prepare the bobbin and the overlay surface for bonding with the bonding adhesive. Scrub with a wire brush and wipe with a clean cloth to remove all contaminants from the surfaces.

3. Apply the adhesive to the overlay. Carefully follow the manufacturer's mixing and/or application instructions.

4. Position the bobbin on the isolated island of the bonded overlay or seal course.

5. When the bobbin has been heated, allow it to cool to within 10°C of the ambient air temperature. Allow 30 min for cooling, or check the bobbin with a pyrometer to ensure that the cooling process has been completed.

6. Record the temperature of the overlay.

7. When the bobbin has reached an acceptable temperature, position the testing apparatus over it and level the testing apparatus. Screw the cable into the threaded bobbin hole.

8. Apply the proper loading by rotating the handle at a speed required to increase tension to the bobbin at the approximate rate of 400 N every 5 s until failure (see Figure 6).

B. CALCULATION OF RESULTS

When the test is completed, record the maximum tensile load developed before failure, as indicated on the gauge of the test apparatus. Convert this into unit stress (MPa) according to the following formula:

Tensile strength (MPa) = L/A

Where L = tensile load (N)
A = surface area of bobbin (mm^2)

Record the nature of the failure, which is described by stating the percentage of the cross section of the break which reveals failure in the overlay, in adhesion between the overlay and the concrete, and/or in the concrete road surface.

Also record the type of failure in percent of total area for the various type failures possible. The following is a typical example of data recorded:

Maximum tensile loading – 2180 N

Type of failure– 85 % concrete pavement,
10 % adhesion,
5 % overlay.

The various type failures possible are:

1. Adhesion between adhesive and bobbin.

2. Cohesion of adhesive.

3. Adhesion between adhesive and bonded overlay.

4. Cohesion in bonded overlay.

5. Adhesion between bonded overlay and concrete surface.

6. Cohesion of concrete surface.

D. PRECAUTIONS TO BE NOTED IN PERFORMING TESTS

1. Since the purpose of this test is to determine the stress required to cause failures of the Types 4, 5, and 6 (above), the test should be rerun if failures of Types 1, 2, or 3 result. This includes drilling new annular holes. Continued failures in the adhesive or the bond of the adhesive indicate that an improper adhesive or technique for applying the adhesive is being used.

2. Failures of Type 1 and 3 could be caused by improper cleaning of the bobbin or the bonded overlay prior to application of the adhesive.

3. Repeated failures of Type 4 indicate poor quality of the bonded overlay, or that the bobbin has not been allowed to cool sufficiently before the tests are conducted.

PART 2. EVALUATION OF SOUNDNESS OF PORTLAND CEMENT CONCRETE SURFACES

A. TEST PROCEDURE

1. To test the surface soundness of concrete, clean a 100- by 100-mm area of surface to remove contaminants that may prevent a good bond between the concrete and the adhesive. This is accomplished preferably by sandblasting, or alternately by scrubbing with a wire brush and wiping with a clean rag dipped in a volatile solvent.

2. Without cutting the annular hole, as described in paragraph 1, Section A of Part 1, bond the bobbin directly to the surface in the center of the 100 mm by 100 mm area. Then perform the test as described in Section A of Part 1.

3. If the test results in failure in cohesion of the epoxy resin adhesive or any failure in adhesion, repeat the test. Repeated failures in adhesion, or cohesion in the adhesive, indicate improper cleaning of the concrete, wrong adhesive, or faulty adhesive application techniques.

4. Record the maximum tensile load developed before failure.

B. CALCULATION OF RESULTS

Calculate results as shown in Section B of Part 1.

PART 3. EVALUATION OF CLEANNESS OF PORTLAND CEMENT CONCRETE SURFACES

A. TEST PROCEDURE

1. Without drilling an annular hole, or cleaning the concrete surface, bond a bobbin directly to the concrete surface. Since the purpose of this test is to evaluate the cleanness of a surface, no surface preparation shall be undertaken.

2. Clean the bobbin by alternately scrubbing with a wire brush and wiping with a clean cloth dipped in volatile solvent.

3. Apply adhesive to the bobbin and the concrete surface.

4. Position the bobbin and perform the test as described in Section A of Part 1.

5. Failures in the bond between the bobbin and the adhesive, or cohesive failures in the adhesive, nullify this test. As discussed above, repeated problems of this type indicate improper adhesive or adhesive application techniques.

6. When the test has been completed, record the maximum tensile load. Also record the percentage of failure occurring in the concrete and percentage of adhesion failure.

B. CALCULATION OF RESULTS

Calculate results as shown in Section B of Part 1.

PART 4. METHOD OF TESTING IN A LABORATORY

When this test is used in the laboratory, a universal testing machine may be substituted for portable tensile tester. The test procedure can be used for evaluating the adhesion and relative tensile properties of bonded overlays. Substrates for the overlays to be tested may be well cured portland cement concrete.

F. SAFETY AND HEALTH

Prior to handling, testing or disposing of any waste materials, testers are required to read: Part A (Section 5.0), Part B (Sections: 5.0, 6.0 and 10.0) and Part C (Section 1.0) of Caltrans Laboratory Safety Manual. Users of this method do so at their own risk.

REFERENCES

End of Text (California Test 420 contains 5 Pages)

Figure 1
Tensile Tester

Figure 2
Cutting "Islands" for Testing Overlays

Figure 3
"Islands" Ready for Bonding Bobbins

Figure 4
Bobbin in Place

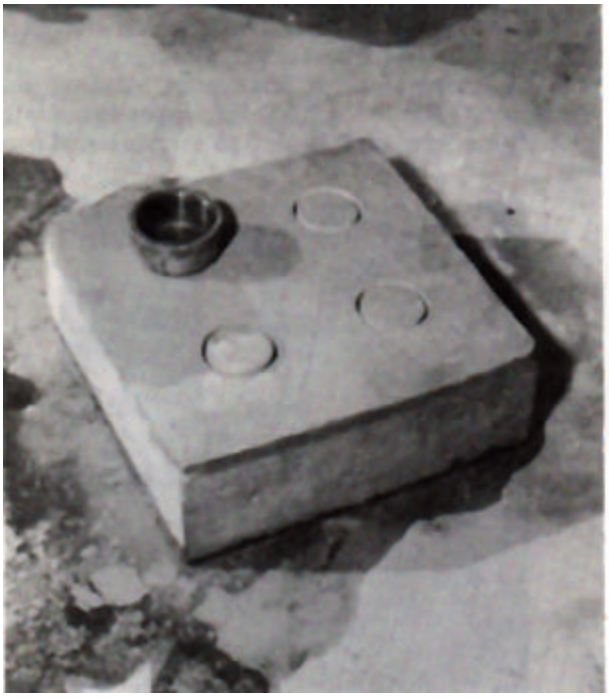

Figure 5
Pipe Bobbin in Place

Figure 6
Determining Tensile Strength